

LISTING OF THE CLAIMS

The present listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently Amended) A multi-output electric power source device comprising:
~~a plurality of~~ first and second constant voltage generating circuits for changing an input voltage from an external electric power source to predetermined supply voltages to be supplied to a vehicle-mounted electronic control device, ~~at least two of wherein the~~ first constant voltage generating circuits comprises a first switching regulator and the second constant voltage generating circuit comprises a second switching having switching-regulator for changing, and wherein the first and the second switching regulators regulate the input voltage;

an abnormal condition detector circuit for detecting an occurrence of ~~the~~ an abnormal condition ~~in the constant voltage generating circuits in~~ of either one of the first and second constant voltage generating circuits; and

protection means provided for each of the constant voltage generating circuits to interrupt or limit an output of a supply voltage from the ~~corresponding~~ constant voltage generating ~~circuits~~ circuit in which the abnormal condition was detected and the other of the first and second constant voltage generating circuits when the abnormal condition is detected,

wherein the abnormal condition detector circuit is provided in common for the ~~at least two~~ first and second constant voltage generating circuits to ~~interrupts~~ interrupt or limit the output of the supply voltage in ~~all~~ both of the constant voltage generating

circuits when the abnormal condition is detected by the abnormal condition detector circuit while maintaining the input voltage.

2. (Currently Amended) A multi-output electric power source device according to claim 1, wherein the protection means interrupts or limits the output from the first and second switching ~~regulator~~ regulators to interrupt or limit the output of the supply voltage, when the abnormal condition is detected by the abnormal condition detector circuit.

3. (Currently Amended) A multi-output electric power source device according to claim 1, wherein:

at least one of the constant voltage generating circuits includes a re-regulating circuit for further changing the output from the respective switching regulator; and

the protection means including the re-regulating circuit, interrupts or limits the output from the re-regulating circuit when the abnormal condition is detected by the abnormal condition detecting circuit.

4. (Currently Amended) A multi-output electric power source device according to claim 3, wherein the constant voltage generating circuit having the re-regulating circuit includes:

over-current detector which detects an electric current flowing through a current-carrying path of from an input side of the re-regulating circuit to a supply voltage output side, and determines the current to be an over-current when it exceeds a preset threshold current value; and

an over-voltage detector which detects a voltage input to the re-regulating circuit and determines the input voltage to be an over-voltage when it exceeds a preset threshold voltage value; and wherein

the protection means in all of the constant voltage generating circuits interrupts or limits the output from the first and second switching ~~regulator~~ regulators to interrupt or limit the output of the supply voltage, when the over-voltage or the over-current is detected.

5. (Original) A multi-output electric power source device according to claim 4, wherein the protection means having the re-regulating circuit interrupts or limits the output from the re-regulating circuit, when the over-voltage or the over-current is detected.

6. (Currently Amended) A multi-output electric power source device according to claim 2, wherein:

each of the first and second switching ~~regulator~~ regulators includes a transistor provided on a current-carrying path of from the input voltage side to the supply voltage output side, and switching control means for turning the transistor on and off so that the output voltage of the switching regulator assumes a preset target voltage; and

the protection means interrupts or limits the output from the switching regulator by interrupting the control signal output to the transistor from the switching control means for on/off control in the switching regulator to interrupt or limit the output of the supply voltage.

7. (Currently Amended) A multi-output electric power source device according to claim 2, wherein:

each of the first and second switching ~~regulator~~ regulators includes a transistor provided on a current-carrying path of from the input voltage side to the supply voltage output side, and switching control means for turning the transistor on and off so that the output voltage of the switching regulator assumes a preset target voltage; and

the protection means interrupts or limits the output from the switching regulator by halting the operation of the switching control means in the switching regulator to interrupt or limit the output of the supply voltage.

8. (Original) A multi-output electric power source device according to claim 6, wherein the transistor of each switching regulator is arranged close to each other, and the abnormal condition detector circuit has at least one temperature detector means arranged close to each transistor to detect the over-heat of the transistor.

9. (Original) A multi-output electric power source device according to claim 8, wherein each transistor and the temperature detector means are formed in a same semiconductor integrated circuit.

10. (Original) A multi-output electric power source device comprising:
a plurality of constant voltage generating circuits having respective switching regulators for changing an input voltage from an external electric power source to

predetermined supply voltages to be supplied to a vehicle-mounted electronic control device, wherein at least two constant voltage generating circuits are constructed as common constant reference voltage generating circuits;

the switching regulators of the common constant reference voltage generating circuits including transistors formed on a current-carrying path from an input voltage side to a supply voltage output side, and switching control means for turning the transistor on/off so that the output voltage of the switching regulator becomes a preset target voltage;

the switching control means including attenuation means for attenuating its own output voltage that is fed back to a voltage of a predetermined level, error output means for comparing an attenuated voltage attenuated by the attenuation means with a predetermined reference voltage to produce an error signal corresponding to a difference between the two, and duty signal generating means for comparing the error signal from the error output means with a predetermined reference waveform to form a duty signal for turning the transistor on/off based upon the compared result;

the attenuation means having such output voltage attenuation ratios that attenuated voltages of when the target voltages of the corresponding switching regulators are fed back assume the same value among the switching regulators possessed by all common constant reference voltage generating circuits;

a reference voltage generating means that provides the reference voltage and is used in common by all of the common constant reference voltage generating circuits; and

a reference waveform generating means that provides a reference waveform and is used in common by all of the common constant reference voltage generating circuits.

11. (Original) A multi-output electric power source device according to claim 10, wherein the target voltages are different among the common constant reference voltage generating circuits.

12. (Original) A multi-output electric power source device according to claim 10, wherein the reference voltage generating means so changes the reference voltage that the output voltage of the switching regulators gradually increases up to the target voltage at the start of operation of the switching regulators in the common constant reference voltage generating circuits.

13. (Original) A multi-output electric power source device according to claim 10, wherein the attenuation means, the reference voltage generating means and the reference waveform generating means are constructed in a same semiconductor integrated circuit.

14. (Original) A multi-output electric power source device according to claim 10, further comprising:

an abnormal condition detector circuit which is so constructed as to detect an occurrence of an abnormal condition in any one of the common constant reference voltage generating circuits; and

at least either one of reference voltage-limiting means for interrupting or limiting the output of the reference voltage from the reference voltage generating means or

reference waveform-limiting means for interrupting or limiting the output of the reference waveform from the reference waveform generating means,

wherein, when an abnormal condition is detected by the abnormal condition detecting circuit, the reference voltage-limiting means or the reference waveform-limiting means provided in the multi-output electric power source device executes the operation.

15. (Currently Amended) A vehicle-mounted electronic control device having at least two circuits that receive different electric power source voltages from an external unit, and operate upon exchanging signals relative to each other, wherein ~~the~~ a multi-output electric power source device ~~of claim 1~~ is used as the electric power source device for supplying different electric power source voltages to the at least two circuits, the electric power source voltages being supplied to the at least two circuits from the constant voltage generating circuits to be protected, the multi-output electric power source device comprising:

a plurality of constant voltage generating circuits for changing an input voltage from an external electric power source to predetermined supply voltages to be supplied to a vehicle-mounted electronic control device, at least two of the constant voltage generating circuits having switching regulators for changing the input voltage;

an abnormal condition detector circuit for detecting an occurrence of an abnormal condition in the constant voltage generating circuits in either one of the constant voltage generating circuits; and

protection means provided for each of the constant voltage generating circuits to interrupt or limit an output of a supply voltage from the corresponding constant voltage generating circuits when the abnormal condition is detected,

wherein the abnormal condition detector circuit is provided in common for the at least two constant voltage generating circuits to interrupt or limit the output of the supply voltage in all of the constant voltage generating circuits when the abnormal condition is detected by the abnormal condition detector circuit.

16. (Original) A vehicle-mounted electronic control device having a plurality of circuits that operate upon receiving power supply from an external unit, wherein the multi-output electric power source device of claim 10 used as the electric power source device for supplying different electric power source voltages to at least two circuits among the plurality of circuits, the electric power source voltages being supplied to the at least two circuits from the common constant reference voltage generating circuits.

17. (Original) A vehicle-mounted electronic control device according to claim 16, wherein the at least two circuits include a microcomputer and an external circuit that exchanges signals relative to the microcomputer.

18. (New) A multi-output electric power source device according to claim 1, wherein:

at least one of the constant voltage generating circuits includes a re-regulating circuit for further changing the output from the respective switching regulator; and

the protection means including the re-regulating circuit, interrupts or limits the output from the re-regulating circuit when the abnormal condition is detected by the abnormal condition detecting circuit when an over-voltage or an over-current is detected.

19. (New) A multi-output electric power source device according to claim 18, wherein the constant voltage generating circuit having the re-regulating circuit includes:

over-current detector which detects an electric current flowing through a current-carrying path of from an input side of the re-regulating circuit to a supply voltage output side, and determines the current to be the over-current when it exceeds a preset threshold current value; and

an over-voltage detector which detects a voltage input to the re-regulating circuit and determines the input voltage to be the over-voltage when it exceeds a preset threshold voltage value; and wherein

the protection means in all of the constant voltage generating circuits interrupts or limits the output from the first and second switching regulators to interrupt or limit the output of the supply voltage, when the over-voltage or the over-current is detected.

20. (New) A multi-output electric power source device comprising:

a plurality of constant voltage generating circuits for changing an input voltage from an external electric power source to predetermined supply voltages to be supplied to a vehicle-mounted electronic control device, at least two of the constant voltage generating circuits having switching regulators for changing the input voltage;

an abnormal condition detector circuit for detecting an occurrence of an abnormal condition in the constant voltage generating circuits in either one of the constant voltage generating circuits; and

protection means provided for each of the constant voltage generating circuits to interrupt or limit an output of a supply voltage from the corresponding constant voltage generating circuits when the abnormal condition is detected,

wherein the abnormal condition detector circuit is provided in common for the at least two constant voltage generating circuits to interrupt or limit the output of the supply voltage in all of the constant voltage generating circuits when the abnormal condition is detected by the abnormal condition detector circuit,

wherein at least one of the constant voltage generating circuits includes a re-regulating circuit for further changing the output from the switching regulator and the protection means including the re-regulating circuit, interrupts or limits the output from the re-regulating circuit when the abnormal condition is detected by the abnormal condition detecting circuit when an over-voltage or an over-current is detected.

21. (New) A multi-output electric power source device according to claim 20, wherein the constant voltage generating circuit having the re-regulating circuit includes:

over-current detector which detects an electric current flowing through a current-carrying path of from an input side of the re-regulating circuit to a supply voltage output side, and determines the current to be the over-current when it exceeds a preset threshold current value; and

an over-voltage detector which detects a voltage input to the re-regulating circuit and determines the input voltage to be the over-voltage when it exceeds a preset threshold voltage value; and wherein

the protection means in all of the constant voltage generating circuits interrupts or limits the output from the first and second switching regulators to interrupt or limit the output of the supply voltage, when the over-voltage or the over-current is detected.

22. (New) A multi-output electric power source device comprising:

a plurality of constant voltage generating circuits for changing an input voltage from an external electric power source to predetermined supply voltages to be supplied to a vehicle-mounted electronic control device, at least two of the constant voltage generating circuits having switching regulators for changing the input voltage;

an abnormal condition detector circuit for detecting an occurrence of an abnormal condition in the constant voltage generating circuits in either one of the constant voltage generating circuits; and

protection means provided for each of the constant voltage generating circuits to interrupt or limit an output of a supply voltage from the corresponding constant voltage generating circuits when the abnormal condition is detected,

wherein the abnormal condition detector circuit is provided in common for the at least two constant voltage generating circuits to interrupt or limit the output of the supply voltage in all of the constant voltage generating circuits when the abnormal condition is detected by the abnormal condition detector circuit,

wherein the protection means interrupts or limits the output from the switching regulator to interrupt or limit the output of the supply voltage, when the abnormal condition is detected by the abnormal condition detector circuit,

wherein the switching regulator includes a transistor provided on a current-carrying path from the input voltage side to the supply voltage output side, and switching control means for turning the transistor on and off so that the output voltage of the switching regulator assumes a preset target voltage and wherein the protection means interrupts or limits the output from the switching regulator by interrupting the control signal output to the transistor from the switching control means for on/off control in the switching regulator to interrupt or limit the output of the supply voltage,

wherein each transistor and the temperature detector means are formed in a same semiconductor integrated circuit.